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SIMULATED ELECTRIC GLOWING EMBERS SYSTEM FOR FIREPLACES

Field of the Invention

This invention relates to fireplaces. In addition, the invention relates to a simulated electric glowing embers system disposed within a fireplace.

Background of the Invention

Gas, electric, and wood burning fireplaces are an efficient method for providing warmth and creating the appeal of a fire within a room. Fireplaces have become commonplace in today's building trades for both residential and commercial applications. Most new home construction designs include at least one, and often several fireplaces. Further, a significant number of remodeling projects are focused on fireplaces.

The representation of glowing embers in such fireplaces is desirable to provide the realistic effect of a fire. Previous systems created to provide artificial glowing embers typically call for a glass panel with artificial embers fused to the panel and a light source positioned below the panel to illuminate the embers and thereby create the illusion of glowing embers. However, such systems have several drawbacks.

First, previous systems do not perform well in high temperatures. The materials used to create the artificial embers break down at the higher temperatures found in fireplaces, and such systems require that the illumination device be remotely positioned from the combustion chamber enclosure because of the intense heat created in the combustion chamber. Second, the individual simulated glowing embers provided in the systems are not movable or adaptable to different burning environments because the simulated embers in the previous systems are fused together and to the glass panel. Third, the previous systems fail to provide the most aesthetically appealing embers

because the artificial embers are fused and therefore create only a two-dimensional look. Fourth, the composition of the materials selected to create the artificial embers do not create a naturally looking ember bed.

Summary of the Invention

Generally, the present invention relates to gas, electric, or wood burning fireplaces. One embodiment may include a fireplace comprising an enclosure defining a chamber, a support structure disposed within the chamber, a plurality of translucent artificial embers disposed upon a top surface of the support structure; and a light source positioned to pass light through at least a portion of the support structure to illuminate the translucent artificial embers.

In another respect, the invention is directed to a fireplace comprising an enclosure including a support structure, a plurality of translucent artificial embers disposed upon a top surface of the support structure, and a light source positioned to pass light through at least a portion of the support structure to illuminate the translucent artificial embers.

In another respect, the invention is directed to an apparatus for electrically simulating glowing embers within a fireplace comprising a support structure, a plurality of translucent artificial embers disposed upon a top surface of the support structure, and a light source positioned to pass light through the ember support bed to illuminate the translucent artificial embers.

In another respect, the invention is directed to an apparatus for electrically simulating glowing embers within a fireplace comprising an ember support bed, a plurality of translucent artificial embers individually arrangeable upon a top surface of the ember support bed, and a light source positioned to pass light through at least a portion of the ember support bed to illuminate the loose translucent artificial embers.

In another respect, the invention is directed to an apparatus for electrically simulating glowing embers within a fireplace comprising a means for supporting a

plurality of translucent artificial embers and a means for illuminating the translucent artificial embers.

In another respect, the invention is directed to a method for electrically simulating glowing embers within a fireplace, the method including: providing an enclosure defining a combustion chamber, disposing a support structure within the combustion chamber, arranging a plurality of translucent artificial embers on a top surface of the support structure, and passing light through at least a portion of the support structure to illuminate the translucent artificial embers.

The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. The figures and the detailed description that follow more particularly exemplify these embodiments.

Brief Description of the Drawings

The invention may be more completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

Figure 1 is a schematic side cross-sectional view of an embodiment of a direct vent gas fireplace incorporating an embodiment of the simulated electric glowing ember system, according to the invention;

Figure 2 is a schematic detailed view of the embodiment of the simulated electric glowing ember system of Figure 1;

Figure 3 is a schematic top view of one embodiment of the support structure of Figure 1;

Figure 4A is a schematic top view of one embodiment of an ember support bed, according to the invention;

Figure 4B is a schematic top view of a second embodiment of an ember support bed, according to the invention;

Figure 4C is a schematic top view of a third embodiment of an ember support bed, according to the invention;

Figure 5 a schematic side cross-sectional view of a second embodiment of a direct vent gas fireplace incorporating a second embodiment of the simulated electric glowing ember system, according to the invention;

Figure 6 is a schematic detailed view of the embodiment of the simulated electric glowing ember system of Figure 5;

Figure 7 is a schematic side cross-sectional view of a third embodiment of a direct vent gas fireplace incorporating a third embodiment of the simulated electric glowing ember system, according to the invention;

Figure 8 is a schematic side cross-sectional view of an embodiment of an electric fireplace incorporating the simulated electric glowing ember system of Figure 2, according to the invention;

Figure 9 is a schematic side cross-sectional view of an embodiment of a multisided gas fireplace incorporating an embodiment of the simulated electric glowing ember system of Figure 2, according to the invention; and

Figure 10 is a schematic front cross-sectional view of the multisided gas fireplace of Figure 9 incorporating the simulated electric glowing ember system of Figure 2.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

Detailed Description of the Preferred Embodiment

The present invention relates to gas, electric, or wood burning fireplaces. In particular, the present invention is directed to a simulated electric glowing embers system disposed within a fireplace. While the present invention is not so limited, an appreciation of various aspects of the invention will be gained through a discussion of the examples provided below.

Referring to Figure 1, a side elevation in section of a direct vent gas fireplace 100 is shown including a simulated glowing ember system 110. An example of a direct vent fireplace is of the type shown and described in U.S. Patent No. 4,793,322, herein incorporated by reference.

Fireplace 100 includes an enclosure 120 that defines a chamber 122. A portion or all of the enclosure 120 can be used for the combustion of burnable or combustible fuels. It will be understood that as used herein, the term "enclosure" is any structure that at least partially surrounds the simulated glowing ember system and is intended to be included in embodiments of all types of known fireplaces, including fireplaces that simulate combustion and do not combust a burnable or combustible fuel. An example of an enclosure that does not include combustion within its defined chamber is illustrated as enclosure 720 in an embodiment disclosed in Figure 7, which defines chamber 722.

In one embodiment of the invention shown in Figure 1, the glowing embers system 110 is shown disposed within the chamber 122 between a gas burner 123 and a bottom panel 125 of the enclosure 120. The gas burner is generally located at 123, but not specifically illustrated in Figure 1. The glowing embers system 110 includes a support structure 124, a plurality of translucent artificial embers 126 disposed upon the support structure 124, and light source 128. At least a portion of the support structure 124 allows light to pass from the light source 128 to the translucent artificial embers 126 to simulate the glowing embers of a fire within a fireplace.

In Figure 1, the glowing ember system 110 is shown, for example, disposed within a direct vent fireplace 100. Figure 2 shows in greater detail an embodiment illustrating the glowing embers system 110 of Figure 1. Some examples of additional fireplace structures with which the glowing ember system of this invention could be used include universal vent, horizontal/vertical vent, B-vent, and dual direct vented fireplaces, as well as multisided units having two or three glass panels as side panels, or in any other unit used as a gas, electric, or wood burning fireplace, stove or insert.

As shown in Figure 1, the support structure 124 can divide the chamber 122 into a combustion air chamber 162 and a combustion chamber 163. The support structure 124 and that portion of the enclosure 120 in which combustion occurs form the combustion chamber enclosure 121 and define the combustion chamber 163. The support structure 124 can include a raised floor 130 and an ember support bed 132. The raised floor 130 is positioned above the bottom panel 125 of the enclosure 120.

Referring to Figure 3, a top schematic view of the ember support bed 124 disposed upon the raised floor 130 of Figure 1 is shown. The ember support bed 132 is placed on a top surface 134 of the raised floor 130. The raised floor 130 can include, for example, a rectangular opening over which is placed the glowing ember support bed 132. The opening can be any other desired shape or can include multiple openings. The raised floor 130 and ember support bed 132 can optionally define one or more air gaps 137 to allow fresh combustion air to pass into the chamber 122. The ember support bed 132 can be held into place over the light source with, for example, sheet metal clamps. Any other suitable means, such as high temperature adhesive, flanges, or screws, can alternatively be used to hold the ember support bed in position.

Alternatively, the raised floor can be constructed so the top surface of the ember support bed is positioned at approximately the same level as the top surface of the raised floor. For example, the raised floor can include a recessed area sized to fit the ember support bed and include flanges to support the ember support bed above the bottom panel of the enclosure.

One embodiment of the ember support bed 132 shown in Figure 1 is a solid plate that may be constructed of material such as ceramic glass, tempered glass, or a ceramic/glass composite material. The solid plate is constructed of a clear or translucent material that allows light from the light source 128 to pass through to translucent artificial embers 126. A typical ceramic glass plate can withstand temperatures in excess of 1400 degrees Fahrenheit. A typical tempered glass plate can withstand temperatures in excess of 600 degrees Fahrenheit. The glass can be colored with stove paint to enhance the glowing color of the translucent artificial embers. Alternatively, the glass plate can be formed into colored glass for generating a desired glowing ember effect.

Other materials that can withstand high temperatures that can be present within the combustion chamber can also be used to construct the plate, such as, for example, metal. Further, a combination of two or more materials may be bonded together to form the plate.

In the embodiment shown in Figure 1, the ember support bed 132 is a non-perforated plate of material. Examples of other configurations for ember support beds are shown in Figures 4A-4C. In a second ember support bed embodiment, illustrated in Figure 4A, a wire mesh ember support bed 432A can be used having individual longitudinal wires 433 and latitudinal wires 435. The spaces 437 between wires may vary in size so long as the spaces 437 are not large enough to allow an individual translucent artificial ember to pass through the ember support bed 432A.

In a third ember support bed embodiment includes a plate 432B defining a plurality of slots 439 (Figure 4B). The slots 439 may be of varying dimension, so long as the space is not large enough to allow individual translucent artificial embers to fall through the ember support bed 432B.

In a fourth ember support bed embodiment shown in Figure 4C, the ember support bed 432C is formed with a plurality of apertures 441. Once again, the diameter of each aperture 441 must be less than the size of individual translucent artificial embers.

The ember support beds shown in Figures 1 and 4A-4C are by way of example only, and many other configurations are possible. For example, the surface of the ember support beds can include, for example, multiple elevations to aid in the placement of translucent artificial embers at different pitches and heights. Further, the ember support bed need not be a separate component, but may be formed integrally with other components of the fireplace, such as the raised floor 130 shown in Figure 1.

The ember support bed shown in the various embodiments can be constructed of various types of materials and preferably of ceramic or glass, or other suitable high-temperature materials, such as metal or refractory materials. The wire mesh, slotted, and aperture configurations of Figures 4A-4C also allow for combustible gas, as shown, for example in Figures 5 and 6, or air, as shown in Figure 7, to pass through the ember support bed.

The translucent artificial embers 126 can be disposed on the ember support bed 132 in any arrangement desired. The translucent artificial embers 126 are constructed as individual pieces that allow for increased placement flexibility thereof upon the ember support bed 132. The ember support bed 132 can be constructed of a clear or translucent material, such as high-temperature ceramic glass, to allow light to pass therethrough from the light source 128 to the translucent artificial embers 126.

The translucent artificial embers 126 are not integrally attached to each other or to the ember support structure 132. Because the translucent artificial embers are not fused to the ember support structure, there is use flexibility in the amount of artificial embers that can be provided and the arrangement of the artificial embers on the support structure. During or after installation of the fireplace, translucent artificial embers 126 may be added, removed, or rearranged to provide a more aesthetically pleasing fire. Further, the individual translucent artificial embers provide a more three-dimensional, aesthetically pleasing look that resembles real embers because each translucent artificial ember is separate rather than being fused together and to the ember support structure. Alternatively, the translucent artificial embers can be formed into a joined array of

artificial embers through adhesion or other connective techniques and placed as a single unit upon the ember support structure.

Individual translucent artificial embers may come in a variety of shapes and sizes. For example, translucent artificial embers can be generally cubical, spherical, jagged, or irregular in shape. Although different sizes may be used, embers can preferably be sized with average diameters between about 1/8 inch and 3/4 inch. It should be understood that other shapes, sizes, and dimensions might be used without departing from the scope of the invention. Further, a combination of differently shaped and sized translucent artificial embers may be used to better simulate a glowing ember bed.

The translucent artificial embers may be made from a variety of materials. The materials selected to create the translucent artificial embers preferably should perform in high temperatures without foaming or breaking up and also be semi-transparent to allow light to pass through them to simulate glowing. For example, fused silica particles can be used for the translucent artificial embers. The material utilized for the translucent artificial embers in one embodiment of the invention is a fused silica material manufactured by C-E Minerals, located in King of Prussia, Pennsylvania, and sold under the Teco-Sil® mark. Teco-Sil® silica is a high purity fused silica with greater than 99% non-crystalline SiO_2. Less than 1% of Teco-Sil® silica includes Cristobalite. Teco-Sil® silica has a melting point of greater than 3000 degrees Fahrenheit.

Fused silica is a preferred material for the embers that withstands very high temperatures without foaming or breaking up. Also, fused silica will not bind to the ember support bed during combustion within the combustion chamber. Further, it provides an aesthetically pleasing glow when illuminated because the fused silica diffuses light in a more natural way than other materials. It should be understood, however, that other translucent, high temperature material could also be used to make the translucent artificial embers.

In one embodiment of the invention, paint or other darkening material can be applied to the surface of a translucent artificial ember. An individual translucent

artificial ember can be provided, for example, with paint applied to at least a portion of the surface of the ember. Paint can be applied to the plurality of translucent artificial embers of an ember bed to give the effect of a bed having "cool" ember top and a hot glowing underside. The paint, normally a black or charcoal color, may be applied to a portion of translucent artificial embers or to all of them. Other colorization sources besides paint may also be used, such as, for example, pigmentation that could be added during manufacturing of the translucent artificial embers.

Referring to Figures 1 and 2, the light source 128 is shown positioned beneath the ember support bed 132. The light generated by light source 128 passes through the ember support bed 132 and onto the translucent artificial embers 126. Alternatively, the light source can be positioned in any location that provides light to translucent artificial embers, such as disposing the light source on the raised floor. The translucent artificial embers 126 are constructed to pass at least a portion of the light generated by light source 128 through them so as to simulate glowing embers.

In a preferred configuration, an individual light source 128 is used which includes a light bulb 136 and a light socket 138. Although the embodiment in Figure 2 shows a light source including two light bulbs and sockets, it should be understood that one or more light bulbs could be used. Also, more than one light source can be used in the system to enhance the glowing ember effect. Halogen bulbs and ceramic sockets are preferably used to create the light source because these items can withstand the potentially high temperature environment of the fireplace that may exceed 600 degrees Fahrenheit. Halogen bulbs and ceramic sockets are examples of components that can withstand the high temperatures of the fireplace combustion chamber. However, any other suitable light source that can withstand high temperatures may also be used. If the light source is constructed to withstand the high temperatures found in a fireplace, it is not necessary to seal-off the light source from the heat generated in the combustion chamber or to provide other methods to cool the light source. When composed of high temperature materials, the light source can be placed directly within the combustion chamber.

The light source 128 is shown connected to a control box 140 that has an on/off switch 142 located behind a removable intake panel 144. Although the control box 140 and on/off switch 142 are provided in this embodiment of the invention, it is possible that the system could be operated without a control box or switch by wiring the simulated electric glowing embers system to operate when the fireplace is in use. Further, other methods, such as a remote-controlled arrangement, could be used to regulate the light sources of the glowing ember system 110. When the light source 128 is turned on, it provides illumination through ember support bed 132 and thereby illuminates the translucent artificial embers 126.

The light source 128 can be controlled by the control box 140 to create a flickering effect and further enhance the simulation of glowing embers. The light source 128 can project a pattern of random flickering light onto the translucent artificial embers 126, which is non-repetitive and simulates real glowing embers whether or not the gas burner 123 is burning. In some embodiments, it is possible to simultaneous operate the gas burner 123 and the glowing ember system 110 to provide very low heat and create the illusion of an extremely hot fire.

Shadow curtains 146 and 147 can be used to direct the light generated from the light source through the ember support bed 132 and onto the translucent artificial embers 126. The shadow curtains 146 and 147 also reduce the amount of stray light that is observed through other openings and apertures in the fireplace. The shadow curtains 146 and 147 can optionally provide support for the ember support bed 132 through engagement with the bottom panel 125 of the enclosure 120, as shown in Figure 1.

In one embodiment of the invention, the glowing embers system 110 is mounted directly below the gas burner 123 and a log set 148. The gas burner 123 is connected to a gas line 150. The gas line 150 supplies combustible gas to the burner 123 for producing gas flames 152 that pass up and through a log set 148 that is supported by a burner 123. The burner 123 can be formed into a log grate 154 that hides structural elements of the burner 123. Alternatively, the gas burner can be formed into the log set as shown and described in U.S. Patent No. 6,048,195, incorporated herein by reference.

Optionally, the gas line supplying gas to the burner can be hidden from view. For example, a leg of the grate can form a tube for transporting the gas to burner.

A gas control valve 156 is connected to the gas line 150 and regulates the amount of gas that is permitted to pass to the burner 123 for combustion. Fresh combustion air enters through a coaxial duct 158 and comes down through the fresh air duct 160 and into the combustion air chamber 122B located between the raised floor 134 and bottom panel 125. The combustion air can be passed into the chamber 122 through the air gaps 137. Burning the gas/air mixture within the chamber 122 generates products of combustion. The products of combustion are passed through an exhaust 159 that is defined by the enclosure 120.

Referring to Figure 5, a second embodiment of a direct vent fireplace 500 is shown including a second embodiment of the simulated glowing ember system 510. The glowing ember system 510 incorporates a gas burner 523 into its construction. Optionally, a second burner can be incorporated into grate 554 or log set 548. The gas burner 523 includes a burner pan 521 located below an ember support bed 532. The burner 523 is supplied with combustible gas from a gas line 551. As illustrated in more detail in Figure 6, ember support bed 532 includes a plurality of burner apertures 541 that allow combustible gas or a gas/air mixture to pass from through the ember support bed 532 for combustion within the chamber 522. The plurality of apertures can be arranged and configured in any pattern to provide a desired flame pattern on the top surface of the ember support bed 532. The diameter of the apertures can be adjusted to vary the size of flames produced from combustion.

Light source 528 can be disposed within the pan 521 of the burner 523 below the ember support bed 532. Light generated by the light source 528 passes through the burner apertures 541 and onto translucent artificial embers 526 disposed upon the top surface of the ember support bed. With this arrangement, the light source 528 and translucent artificial embers 526 are manufactured to endure excessive amounts of heat created from being located in close proximity to burner 523. Teco-Sil® silica is one example of translucent artificial ember material that can withstand the high temperatures

encountered with this embodiment. The ember support bed 532 can be supported by downwardly depending support members 546 and 547 attached to the burner and in engagement with bottom panel of the combustion chamber, as shown in Figure 5.

Referring to Figure 7, a third embodiment of a direct vent fireplace 700 is shown including a third embodiment of the simulated glowing ember system 710. The fireplace 700 includes an enclosure 720 defining a chamber 722 and the glowing ember system 710. A rear panel 760 and bottom panel 762 of the enclosure 720 and a rear panel 768 and bottom panel 770 of an intermediate enclosure 764 define a fresh air duct 772. The fresh air duct 772 provides for the passage of fresh air from the exterior of the fireplace to the chamber 722, as indicated by the arrows "A" on Figure 7. Fresh combustion air enters through coaxial duct 774 and comes down through the fresh air duct 772.

The glowing ember system 710 includes an ember support bed 732, a lower translucent plate 776, and a light source 728. The ember support bed 732 forms at least a portion of a bottom panel 762 of the enclosure 720 and defines a plurality of apertures 741 for the passage of fresh air from the fresh air duct 772 to the chamber 722. Translucent artificial embers 726 are disposed on the top surface of the ember support bed 732. The lower translucent plate 776 forms at least a portion of the bottom panel 770 of the intermediate enclosure 764. The light source 728 is housed below the lower translucent plate 776 and passes light through the fresh air duct 772 and the ember support bed 732 to illuminate the translucent artificial embers 726. The lower translucent plate 776 and the ember support bed 732 can be constructed of materials, for example, previously described with respect to embodiments of the ember support bed 132 of Figure 1 and beds 432A, 432B, and 432C.

Referring to Figure 8, an embodiment of an electric fireplace 800 is shown including the glowing ember system 810. The glowing ember system 810 is similar in configuration and operation to the glowing ember system 110 previously described with respect to Figure 2. In this embodiment, a log set 848 is disposed in chamber 822 defined by enclosure 820. The log set 848 is mounted directly over simulated electric

glowing embers system 810 having translucent artificial embers 826, an ember support bed 832, and light source 828 positioned below. The simulated electric glowing embers system 810 in this embodiment functions similarly to the glowing ember systems in the embodiments described above.

Referring to Figures 9 and 10, side and front cross-sectional views of a multisided gas fireplace 900 are shown including the embodiment of the glowing ember system 110 of Figure 2. Such a direct vent fireplace is of the type shown and described, for example, in U.S. Patent No. 5,016,609, incorporated by reference.

Fireplace 900 includes an enclosure 920 that defines a chamber 922. A portion or all of the enclosure 920 can be used for the combustion of burnable or combustible fuels. Referring to Figure 10, the glowing embers system 110 is shown disposed within the chamber 922 between a gas burner 923 and a bottom panel 925 of the enclosure 920.

The present invention should not be considered limited to the particular examples described above, or to the materials used to describe the various embodiments, but rather should be understood to cover all aspects of the invention as broadly set out in the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the instant specification.